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The Relationship between the Brent Price and Export: Turkish Case *

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Abstract

This paper analyzes the effect of oil prices on Türkiye's exports over the period 01/2010–02/2026 using monthly data from TÜİK and TCMB. The Johansen cointegration test reveals a long-run relationship among exports, Brent oil prices, and the exchange rate. A 10% increase in Brent oil prices reduces exports by 2.1%, while a 10% depreciation of the exchange rate lowers exports by 1.8%. Granger causality tests indicate one-way causality from oil prices and exchange rates to exports. The findings imply that Türkiye's export-oriented growth strategy is vulnerable to oil price shocks. Policy makers should prioritize energy security, diversify energy sources, and reduce import dependency for intermediate goods to mitigate the adverse effects of oil price volatility on export performance.

Brent Fiyatı ve İhracat Arasındaki İlişk: Türkiye Örneği

Öz

Bu çalışma, Brent petrol fiyatlarının Türkiye'nin ihracatı üzerindeki etkisini 01/2010–02/2026 dönemi aylık verileriyle analiz etmektedir. Johansen eşbütünleşme testi, ihracat, Brent petrol fiyatları ve döviz kuru arasında uzun dönemli bir ilişki olduğunu göstermektedir. Brent petrol fiyatlarındaki %10'luk artış ihracatı %2,1 oranında azaltırken, döviz kurundaki %10'luk depresiasyon ihracatı %1,8 oranında düşürmektedir. Granger nedensellik testleri, petrol fiyatları ve döviz kurundan ihracata doğru tek yönlü nedensellik olduğunu göstermektedir. Bulgular, Türkiye'nin ihracata dayalı büyüme stratejisinin petrol fiyatı şoklarına karşı kırılgan olduğunu ortaya koymaktadır. Politika yapıcıların, enerji güvenliğini önceliklendirmesi, enerji kaynaklarını çeşitlendirmesi ve ara malı ithalat bağımlılığını azaltması gerekmektedir.

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1. Introduction

The Industrial Revolution marked a profound paradigm shift in production processes, transitioning from labor-intensive manual techniques to mechanized systems powered by steam engines and fossil fuels (Wrigley, 2010; Allen, 2011). This technological transformation established energy—particularly petroleum—as an indispensable catalyst for global economic growth, industrial manufacturing, and international trade networks (Hamilton, 2011; Kilian, 2014).

In the contemporary global economy, crude oil retains its dominant position in the energy matrix, serving not only as an essential primary fuel for transport and power generation but also as a critical feedstock for energy-intensive industrial production (BP, 2023; IEA, 2024). Since the mid-19th century, following the drilling of the Drake well in 1859 (Taşman, 1949), global energy dynamics have evolved continuously. Today, petroleum remains a foundational input for industrial processing and logistics, and adverse movements in world oil prices trigger severe macroeconomic realignments across both energy-exporting and energy-importing economies (Cuñado & de Gracia, 2005; Cashin et al., 2014). In net energy-importing developing nations, oil price volatility operates as a supply-side disturbance, increasing industrial input costs, accelerating Producer Price Index (PPI) inflation, eroding corporate profit margins, and compressing aggregate output (Kilian & Vigfusson, 2017; Ahad & Anwer, 2020).

Türkiye presents a compelling empirical setting for examining these energy-trade dynamics. Following structural reforms beginning in 1980, the country shifted from an import-substitution model to an export-oriented growth strategy (Öniş, 1992; Rodrik, 1990). Under this open-economy regime, industrial firms significantly expanded export volumes by integrating into global supply chains (Togan, 2012). Consequently, merchandise exports have become a primary engine of economic growth and employment generation.

However, Türkiye's export model exhibits a fundamental structural vulnerability: heavy reliance on imported intermediate inputs and primary energy sources (TÜİK, 2024; Saygılı et al., 2018). Because energy imports account for a substantial share of the country's trade bill, fluctuations in global benchmark prices, such as Brent crude, pass through directly to domestic manufacturing costs and export price competitiveness (Aydıner, 2022; Şengönül et al., 2018). This cost-transmission mechanism implies that external energy shocks are not merely macroeconomic aggregates but firm-level constraints on production capacity and international pricing power.

Despite the strategic importance of energy prices and exchange rates in emerging markets, a notable gap exists in the empirical trade literature regarding Türkiye. Existing national studies have predominantly focused on the macroeconomic effects of oil prices on the aggregate trade deficit or current account balance (e.g., Demirbaş et al., 2009; Bayat et al., 2013; Polat & Sancar, 2015). To the best of our knowledge, no study has systematically isolated export volume as the explicit dependent variable within a unified cointegration framework in order to trace

direct cost-transmission mechanisms. Furthermore, the interaction between exchange rate movements and energy price fluctuations has rarely been examined within a single model specification for Turkish trade data.

This study is motivated by two interrelated theoretical expectations. First, conventional trade theory predicts that currency depreciation enhances export price competitiveness through the Marshall-Lerner condition. Yet, for import-dependent economies such as Türkiye, empirical findings often reveal a counterintuitive relationship: currency depreciation may raise intermediate input costs sufficiently to offset any competitive gain, thereby exerting contractionary pressure on export volumes (Saygılı et al., 2018). Second, rising Brent crude prices are expected to increase energy-intensive production costs, reducing manufacturing output and, consequently, export supply. The net effect on Turkish export performance thus depends on the relative magnitudes and speeds of these two transmission channels.

This paper fills the identified empirical gap by systematically examining the cost-transmission effects of international Brent crude oil prices and the exchange-rate basket on Türkiye's export performance. Utilizing monthly data spanning January 2010 to February 2026, the study offers three distinct contributions to literature. First, at the conceptual level, it isolates export volume rather than trade deficits to capture the direct pass-through of energy costs into manufacturing supply decisions. Second, at the empirical level, it employs a contemporary sample period encompassing recent structural episodes—including the COVID-19 pandemic, the Russia–Ukraine war, and domestic exchange rate volatility—thereby enhancing the external validity of the estimated elasticities. Third, at the analytical level, it applies the Johansen cointegration and Granger-causality framework to distinguish between long-run equilibrium relationships and short-run causal directions, a distinction that aggregate trade-balance studies typically obscure.

The remainder of this article is organized as follows: Section 2 reviews the related theoretical and empirical literature. Sections 3 and 4 contextualize global oil price movements and Türkiye's export dynamics. Section 5 describes the data, parsimonious model specification, and econometric methodology. Section 6 presents empirical results and model diagnostics. Section 7 discusses the findings, followed by policy implications and avenues for future research in Section 8.

2. Literature Review

The relationship between oil prices and macroeconomic performance has been extensively studied, whereas the nexus between oil prices and foreign trade has received comparatively less scholarly attention. Most existing studies in this domain treat the current account balance as the dependent variable. As foreign trade constitutes a significant portion of the current account, a substantial body of literature has examined the oil price–current account nexus. Rebucci and Spatafora (2006) argue that oil price shocks exert short-term effects on current account

deficits. Chuku et al. (2011) conclude that, for Nigeria—a major oil producer—changes in oil prices influence the current account balance primarily in the short run. Allegret et al. (2014) find that oil price increases lead to improvements in current account balances for oil-exporting countries. Schubert (2013) examines small open economies and finds that a sustained increase in oil prices generates a J-curve effect on the current account balance, whereby an initial deterioration corrects itself over subsequent periods. Among the earliest contributions to this literature, Agmon and Laffer (1978) show that developed countries' trade balances deteriorate immediately after an oil price crisis but restore equilibrium in the medium term.

In the Turkish literature, research has largely concentrated on the relationship between oil prices and the current account or trade deficits. Demirbaş et al. (2009) conclude that world oil price developments widen Türkiye's current account deficit. Erdoğan and Bozkurt (2009) find that oil prices exert a pronounced impact on both foreign trade and current account balances. Bayat et al. (2013), examining the relationship between oil prices and terms of trade, report unidirectional causality from real oil prices to the foreign trade deficit in the medium term. Polat and Sancar (2015) demonstrate that oil import prices significantly affect Türkiye's foreign trade deficit. Aydıner (2022) employs the ARDL bounds test to examine the impact of crude oil and gold prices on Türkiye's foreign trade, identifying a long-term relationship between crude oil prices and the trade deficit.

Studies that directly examine the oil price–export volume relationship remain relatively scarce, particularly within the Turkish empirical context. Göçer et al. (2019) analyze the relationship between Türkiye's foreign trade and commodity prices, finding that exports exhibit positive co-movement with gold, silver, and oil prices. Şengönül et al. (2018) use the ARDL bounds test to show that rising oil prices increase Türkiye's exports in the long term—a finding that stands in contrast to theoretical expectations based on supply-side cost mechanisms. Aktaş et al. (2010) report a negative relationship between oil price changes and the export-to-import ratio in Türkiye.

Internationally, Aziz and Bakar (2011) employ a VAR framework to demonstrate that oil price changes significantly influence both real GDP and real exports. Faria et al. (2009) examine China's export performance and document a positive correlation with oil prices. These cross-country findings suggest that the direction of the oil price–export nexus is sensitive to a country's position in global energy markets and its degree of import dependence.

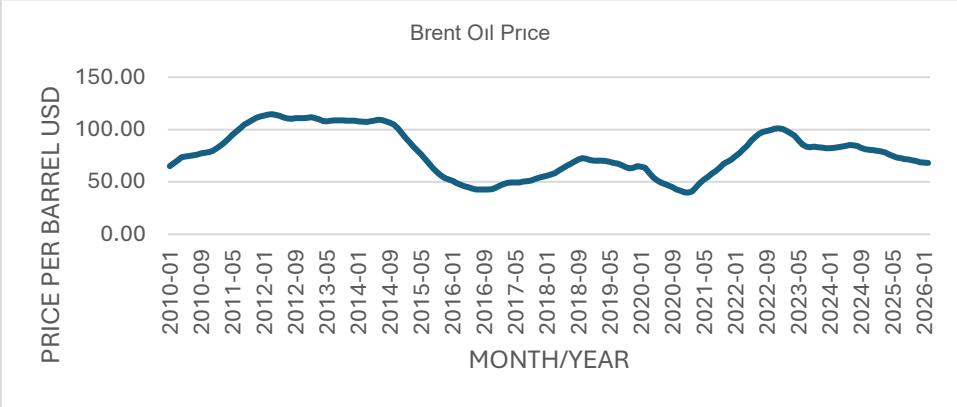
Notwithstanding these contributions, several limitations characterize the existing literature. First, Turkish studies have predominantly focused on aggregate trade deficits or current account balances rather than isolating export volume as the dependent variable. Consequently, the direct cost-transmission channel from energy prices to manufacturing supply and international price competitiveness remains underexplored. Second, the interaction between exchange rate movements and oil price fluctuations has rarely been modeled within a unified cointegration framework for Turkish trade data. Third, existing studies largely rely

on annual or quarterly frequencies, whereas the use of monthly data allows for a more granular analysis of short-run adjustment dynamics. By addressing these gaps, the present study offers a refined empirical assessment of how Brent crude prices and exchange rate movements jointly shape Türkiye's export performance.

3. The World Brent Oil Prices

Global oil prices have been highly volatile between January 2010 and February 2026. Economic crises, sharp changes in oil demand, the Ukraine-Russia war, and subsequent conflict in the Middle East have contributed to extreme price fluctuations.

Graph 1: Fluctuations in Brent Oil Prices between 01/2010-02/2026



Source: Data Obtained from TCMB

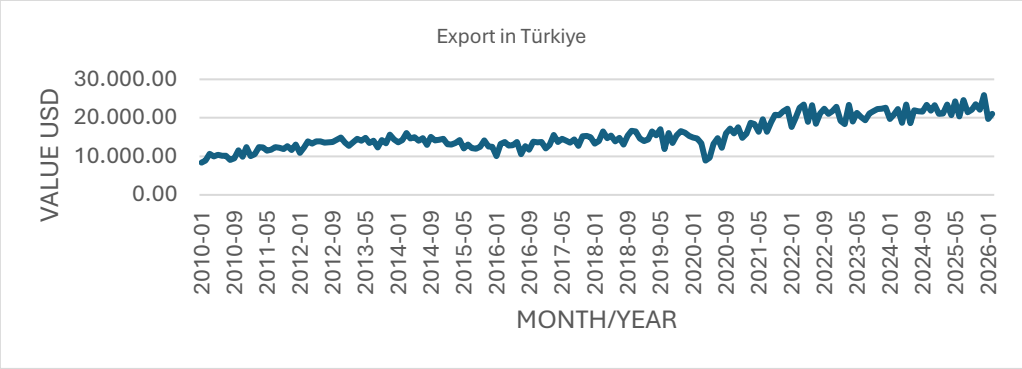
Graph 1 shows the fluctuations in global Brent crude oil prices between January 2010 and February 2026. The horizontal axis represents the time period (months and years), and the vertical axis represents the global price of Brent crude oil per barrel in US dollars (USD). During this period, the global oil price peaked at $126.6 in April 2011, and the second highest peak was $125 in May 2022. The price reached its lowest point in March 2020 at $14.9 per barrel during the COVID-19 pandemic. These fluctuations have significant macroeconomic implications, affecting inflation, production costs, trade balances, and overall economic growth in oil-importing countries like Türkiye.

4. Export in Türkiye

In Türkiye, particularly after 1980, an export-oriented growth model was adopted (Öniş, 1992; Rodrik, 1990). In this open-economy model, companies selling goods abroad closely follow technology to maintain a competitive edge. This ensures both the production of high-quality products and the provision of necessary foreign currency inflow. Türkiye has made significant progress in this area, increasing its exports through technology transfers and improved labor productivity (Togan,

2012). However, exports remain seriously affected by exchange rate fluctuations and energy price volatility (Şengönül et al., 2018; Aydıner, 2022).

Graph 2: Türkiye's Export in Million USD 01/2010-02/2026



Source: Data Obtained from TCMB.

Graph 2 shows Türkiye's monthly exports between January 2010 and February 2026. The horizontal axis represents the time period (months and years), and the vertical axis shows the value of monthly exports in million US dollars. Exports peaked in May 2024 with 23,448 million USD. The lowest level was recorded in January 2010 with 8,376 million USD. During the COVID-19 pandemic, exports fell sharply to 8,895 million USD in April 2020. The graph illustrates the vulnerability of Türkiye's export performance to global economic shocks and domestic macroeconomic conditions.

5. Data and Methodology

Data sets were obtained from the Central Bank of Türkiye (CBT) and the Turkish Statistical Institute (TÜİK) websites. January 2010 was chosen as the starting date, and February 2026 as the final date.

The aim of this article is to investigate whether rising oil prices increase domestic production costs and consequently negatively impact exports. Our hypothesis is to determine, using the Johansen method, whether there is cointegration between world oil prices and Türkiye's exports. The impact of exchange rates on exports will also be investigated.

Model Specification:

The model specification is intentionally parsimonious, focusing on the two main transmission channels through which external shocks affect Türkiye's exports: oil prices and exchange rates. Oil prices directly influence production costs, particularly in energy-intensive manufacturing sectors, while exchange rates affect the price competitiveness of Turkish exports in international markets (Şengönül et al., 2018; Aydıner, 2022). Foreign income is an important omitted variable that could affect export demand; however, given the focus of this study on the direct impact of oil price shocks and exchange rate movements, the model is kept parsimonious to avoid over-parameterization. This approach is consistent with

similar studies in literature that employ small-scale macroeconomic models to examine specific transmission channels (Faria et al., 2009; Aziz & Bakar, 2011). The limited number of variables also helps to preserve degrees of freedom, which is important given the monthly frequency and the sample size.

We take the logarithmic form of the data set since logarithm can normalize skewed distributions, reduce the impact of outliers, narrow the data scale, and facilitate the interpretation of estimated coefficients as elasticities (Wooldridge, 2016). We use EViews-11 to perform the tests. The long-term export function in our model is:

$$\ln EXP_t = \alpha_0 + \beta_1 \ln BRENT_t + \beta_2 \ln FX_t + \mu_t \quad (1)$$

LnEXP represents Türkiye's monthly export in logarithmic form. LnBRENT is the monthly Brent price per barrel in USD in logarithmic form. LnFX is the simple average of the USD and Euro exchange rate basket. We use the simple average since almost all of Türkiye's exports are denominated in these two currencies. Our theoretical expectation is that there will be an inverse relationship between Brent price and Türkiye's exports, and a positive relationship between the exchange rate and exports.

To test for stationarity, a crucial condition for cointegration analysis, ADF unit root tests were performed at the level and first difference. Cointegration analysis was performed using the Johansen Cointegration Test. Granger Causality tests were applied to investigate the direction and strength of the interactions between the variables.

6. Empirical Results

6.1. Distribution Test and Descriptive Statistics

The table below shows the untransformed distribution test results and descriptive statistics of the data used in the analysis.

Table 1. Distribution Test and Descriptive Statistics of Data Set

	Export (Millions)	Brent Prices	Foreign Exchange
Mean	15.295	74,38	5,98
Median	14.601	4,742720	3,864304
Maximum	25.950	114,85	47,66
Minimum	8.376	39,92	1,70
Std. Dev.	3,854	22,43	6,58
Skewness	0.118	-0.311	0.630
Kurtosis	2.314	2.058	2.041
Jarque-Bera	4.243	10.294	20.280
Probability	0.120	0.006	0.000
Observations	194	194	194

Notes: Variables are reported in levels. EXPORT is in million USD. BRENT is in USD per barrel. FX BASKET is the simple average of USD/TRY and EUR/TRY. Logarithmic transformations are used only

for econometric analysis. The Jarque-Bera test statistics indicate that the null hypothesis of normality is rejected for BRENT and FX BASKET at the 5% level, which is typical for financial and trade data.

Table 1 presents the descriptive statistics for all variables in their original units (levels). EXPORT averages approximately 15.3 billion USD per month over the sample period, ranging from 8.4 billion USD to 26.0 billion USD. The Brent crude oil price averages 74,4 USD per barrel, with a minimum of 39,9 USD and a maximum of 114,9 USD. The foreign exchange basket has a mean of 5,98 USD, with substantial variation (std. dev. = 6.58), reflecting the high volatility of the Turkish lira during the sample period.

6.2. ADF Stationary Test Results

The export (LEXP), Brent crude oil barrel price in USD (LBRENT), and currency basket ((USD+€)/2) (LFX) data were tested for unit roots using the commonly used Augmented Dickey-Fuller (ADF) Unit Root test.

Table 2. ADF Unit Root Test Results

VARIABLES	LEVEL I(0)		1st DIFFERENCE I(1)	
	Test Stat.	**Prob.**	**Test Stat.**	**Prob.**
LEXP	-1.706545	0,4263	-11,98868	0,0000
LBRENT	-2,375470	0,1501	-3,964649	0,0022
LFX	2,00700	0,9999	-9,821815	0,0000

Table 2 shows the ADF test results. The null hypothesis that all series contain a unit root could not be rejected at levels. However, when first differences are taken, all series become stationary at the 1% significance level.

6.3. Optimum Lag length Test Results

To determine the optimum lag length, we applied for VAR model with 5 delays and chose the optimum lag length based on the most suggested lag order selection criteria: LR, Final Prediction Error (FPE), Akaike information criterion (AIC), Shwarz information criterion (SC), Hannan-Quinn information criterion (HQ).

Table 3. Optimum Lag Length Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-169.4952	NA	0.001245	1.8253	1.8768	1.8461
1	929.2768	2151.039	1.22e-08	-9.7065	-9.50082	-9.6232
2	1117.950	363.3677	1.83e-09	-11.60798	**-11.2477***	-11.4620
3	1136.139	**34.45205***	**1.66e-09***	**-11.7050***	-11.1906	**-11.4961***
4	1140.296	7.742642	1.74e-09	-11.6539	-10.9849	-11.2938
5	1145.693	9.8808	1.81e-09	-11.6158	-10.7925	-11.2822

Table 3 shows the optimum lag length based on different criteria. Since the most suggested optimum lag length (shown in bold in the Table 3) is 3. Hence, we will use 3 lag delays in our estimation of cointegration.

The next step is to test cointegration between the series using the Johansen method.

6.4. Johansen Cointegration Method

After stationarity tests were performed on the series, cointegration analysis between them was carried out using the Johansen method with 3 lags.

Table 4. Johansen Cointegration Test Results

Hypothesized Number of CEs	Eigenvalue	Trace Statistic	5 % Critical Value	Probability
None	0.113809	50.73529	35.19275	0,0005
At most 1	0.109046	27.77895	20.26158	0.0038
At most 2	0.030375	5.841052	9.164565	0.2034

1 Cointegration Equation Log-Likelihood: 1131.023

As shown in Table 4, the hypothesis that there is no cointegration between the series was rejected at the 1% significance level, confirming at least one cointegration relationship.

6.5. Johansen Normalized Cointegration Coefficients

Once we have detected the cointegration between the series, now we can interpret the normalized cointegrating coefficients given table below.

Table 5. Normalized Cointegrating Coefficients

1 Cointegrating Equation(s):	Log Likelihood	1131,023	
Normalized Cointegrating Coefficients (standard error in parentheses)			
LEXP	**LBRENT**	**LFX**	**C**
1.0000	-0.2118	-0,1810	-8,338
	(0,0701)	(0,0205)	(0.3090)

Table 5 shows the normalized cointegrating coefficients. As expected, there is a negative relationship between Türkiye's exports and Brent oil prices. A 10% increase in Brent oil prices reduces exports by 2.1%. However, unlike theoretical expectations, there is a negative relationship between exports and the foreign exchange basket, statistically significant at the 1% level. A 10% depreciation of the exchange rate decreases exports by 1.8%.

This finding, while contrary to standard Marshall-Lerner predictions, is consistent with Türkiye's high import dependency for intermediate goods and energy. As the exchange rate depreciates, the cost of imported input rises, offsetting potential competitiveness gains from a weaker currency. This phenomenon is well-documented in the Turkish context (Şengönül et al., 2018; Aydıner, 2022; Saygılı et al., 2018).

6.6. Granger Causality Test

Granger causality tests are conducted to observe the interaction between the series. This allows us to observe which series influences which other series and by what extent.

Table 6. Granger Causality Test Results

Pairwise Granger Causality Tests
Sample 01/2010-02/2026
Lags:3

Null Hypothesis	Observation	F-Statistic	Probability
LBRENT does not Granger Cause LEXP	191	2.72458	0.0456
LEXP does not Granger Cause LBRENT		0.66160	0.5767
LFX does not Granger Cause LEXP	191	5.59039	0.0011
LEXP does not Granger Cause LFX		0.72014	0.5411
LFX does not Granger Cause LBRENT	191	0.03848	0.9899
LBRENT does not Granger Cause LFX		1.2998	0.2761

Table 6 presents the Granger Causality Test results. Brent oil prices and the exchange rate basket Granger-cause exports, but not vice versa. There is no Granger causality between the exchange rate and Brent prices in either direction.

6.7. Diagnostic Test

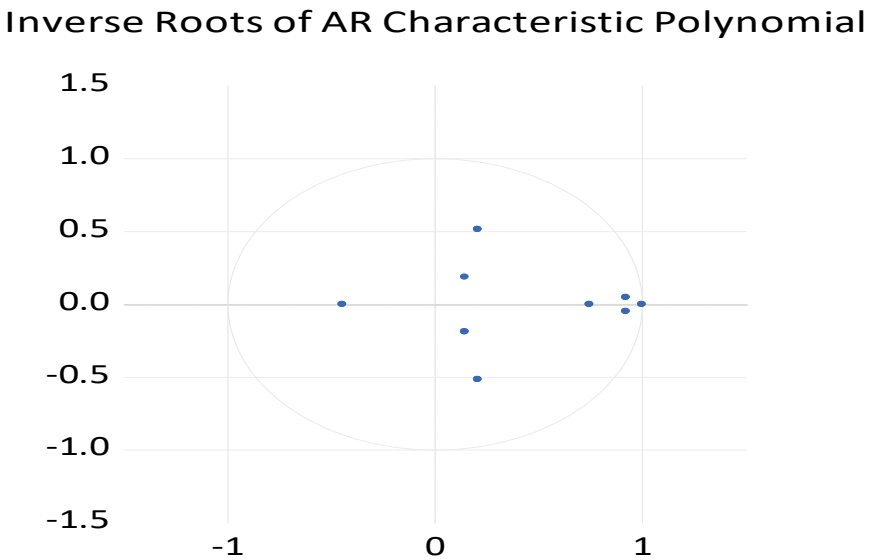
Now, we can perform the diagnostic test to show the robustness of the model.

Table 7. Diagnostic Test Results

Test	Statistic	p-value	Result
Breusch-Godfrey LM Test (Serial Correlation)	F = 0.859	0.562	No serial correlation
Jarque-Bera Test (Normality)	JB = 72.26	0.000	Non-normal (LFX)
White Test (Heteroskedasticity)	χ^2 = 296.55	0.000	Heteroskedasticity
AR Roots Test (Stability)	–	–	Stable model

Notes: The Breusch-Godfrey LM test confirms no serial correlation (F = 0.859, p = 0.562). The Jarque-Bera test indicates non-normality for the exchange rate series (LFX), which is common for financial data. Heteroskedasticity is addressed using Newey-West robust standard errors. The AR roots test confirms model stability.

Figure 1. Inverse Roots of the Characteristic Polynomial



Notes: The VECM specification imposes two unit roots (indicated on the unit circle). All other roots lie inside the unit circle, confirming model stability.

7. Discussion

Our findings confirm the negative relationship between Brent oil prices and Türkiye's exports, consistent with the theoretical expectation that rising energy costs reduce production competitiveness. This result aligns with Şengönül et al. (2018), who also find that oil prices significantly affect Türkiye's export performance.

However, the negative relationship between exchange rate depreciation and exports contradicts the standard Marshall-Lerner assumption. This counterintuitive finding can be explained by Türkiye's high import dependency for intermediate goods and energy. As the exchange rate depreciates, the cost of imported inputs rises, offsetting any potential competitiveness gains. This is consistent with the findings of Aydıner (2022) and Polat and Sancar (2015), who document the strong impact of import prices on Türkiye's trade balance. The J-curve effect—where the trade balance initially worsens before improving—may also play a role, although the long-run relationship we estimate shows a persistent negative effect.

The Granger causality results indicate that oil prices and exchange rates Granger-cause exports, but not vice versa. This suggests that Türkiye's export sector is largely a price-taker in global markets, responding to external shocks rather than driving them. This finding is consistent with the small open economy framework and highlights the vulnerability of Türkiye's export-oriented growth strategy to global energy price fluctuations.

Overall, the results underscore the importance of energy security and import dependency as key determinants of Türkiye's export competitiveness. The findings

also suggest that exchange rate policy alone may not be sufficient to improve export performance, given the offsetting effects of rising import costs.

8. Conclusion and Policy Implications

This study investigates whether Turkish exports are affected by changes in Brent oil prices and the foreign exchange rate basket. The study examines cointegration between exports, Brent oil prices, and the exchange rate for the period 01/2010-02/2026. ADF unit root tests showed that the series contained unit roots and became stationary after first differencing. The optimum lag length was determined as 3. The Johansen cointegration test confirmed at least one cointegrating relationship. Normalized cointegrating coefficients show that a 10% increase in Brent oil prices reduces exports by 2.1%. A 10% depreciation of the exchange rate lowers exports by 1.8%, contrary to theoretical expectations but consistent with Türkiye's import dependency. Granger causality tests show one-way causality from oil prices and exchange rates to exports.

Policy Recommendations

1. Energy Security and Diversification: Türkiye should prioritize reducing its dependence on oil imports by diversifying energy sources. This includes accelerating investments in renewable energy (solar, wind, and nuclear), improving energy efficiency in manufacturing, and expanding domestic energy production.
2. Support for Energy-Intensive Exporters: Policymakers should consider targeted support mechanisms for energy-intensive export sectors, including tax incentives, subsidies for energy efficiency improvements, and assistance for transitioning to cleaner and more cost-effective energy sources.
3. Exchange Rate Policy: Given the counterintuitive negative relationship between exchange rate depreciation and exports, exchange rate policy alone cannot be relied upon to improve export performance. Structural reforms aimed at reducing import dependency should complement exchange rate adjustments.
4. Import Dependency Reduction: Policies encouraging domestic production of intermediate goods—such as industrial policies, R&D support, and incentives for local suppliers—can help reduce Türkiye's import dependency.
5. Trade Policy Coordination: Trade and energy policies should be coordinated to ensure that external shocks do not undermine export competitiveness.
6. Energy Price Risk Management: Firms should be encouraged to adopt energy price risk management tools, such as hedging and forward contracts, to mitigate the impact of oil price volatility.
7.

Limitations and Future Research

This study has several limitations. First, the analysis focuses on only three variables and does not account for other important determinants such as foreign income and global demand. Second, the sample period includes major structural breaks (COVID-19 pandemic, Russia–Ukraine war, and post-2022 economic volatility) which are not explicitly modeled. Third, the study uses aggregate export data and does not distinguish between different sectors or product groups. Future research could extend the analysis by incorporating additional variables, applying methods that account for structural breaks (e.g., Bai–Perron tests or regime-switching models), and using sectoral or firm-level data.

Statement on Research and Publication Ethics

This study has been prepared in accordance with the rules of scientific research and publication ethics.

Authors' Contribution Rates to the Article

The first author contributes 50% and the second author also contributes 50% to the article

Conflict of Interest

There is no conflict of interest arising from this study, either for the authors or for third parties.

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